

XI.—*On the Preservation of Fruits in Chemical Fluids for Museum Purposes.*

By WM. SAUNDERS, F.L.S., F.C.S., Director Experimental Farms.

(Read May 25, 1894.)

During the summer of 1885 the writer was requested to prepare for the Canadian Government a collection of such fruits as could be obtained that year grown in Canada, and to endeavour to preserve them in antiseptic solutions, so that they might be shown at the Indian and Colonial Exhibition to be held in London, England, during the summer of 1886.

Having undertaken this work, I carried on an extensive series of experiments with many sorts of fruits, trying the effect of solutions of a number of antiseptic substances. I also corresponded with many botanists, pathologists and physiologists in the endeavour to gain some information, or at least to have the help of suggestions in this field, which at that time seemed to be almost entirely new. A large number of tests were made, involving many failures. Among the materials used which were found unsuitable for various reasons were solutions of several of the arsenites, carbolic acid, corrosive chloride of mercury, chloride of sodium, glycerine, sugar and strong mixtures of alcohol and water. Finally, however, a good measure of success was reached, and about 1,000 bottles and jars of fruits were preserved in a fairly good and natural condition. The chemicals used as preservatives on this occasion were chiefly solutions of salicylic acid, boric acid, hydrate of chloral and sulphurous acid, the fluid consisting of water mixed with about 25 per cent of alcohol. The sulphurous acid was only used where white or yellow fruits had to be preserved, or where discoloration of the specimens had occurred from any cause. The bleaching effect of this acid gave the fruits preserved in it a handsome but sometimes an unnatural appearance. This exhibit was on the whole a successful one, and formed a very attractive feature in the Canadian court, and the fruits placed on the trophy in May remained in fair condition to the close of the exhibition in October. Unfortunately the jars were returned empty, and hence no opportunity was given of ascertaining how long the specimens would have continued to maintain a natural appearance.

When the World's Columbian Exposition was decided on, a series of experiments was begun at the experimental farm, at my request, by my son, Dr. C. E. Saunders, who tried the effect of many preservative solutions on fruits of different sorts, and on the experience thus gained much of the subsequent treatment was based. At the Indian and Colonial Exhibition all the strawberries had spoilt for the reason that the fluids used were too dense, and as a consequence the specimens floated on the top of the fluid, where they crowded and pressed each other into a shapeless mass. Kerosene oil was found to be the most satisfactory fluid for preserving strawberries, having just about the right density to allow them to settle to the bottom of the jar.

For red and black cherries, black currants, red and black raspberries, and other red and dark coloured fruits, including red and dark grapes and red apples, a 1 per cent solution of boric acid in water was chiefly used. This was afterwards increased in strength with advantage to $1\frac{1}{2}$ and 2 per cent.

For the yellow varieties of raspberries, white and yellow cherries, peaches, gooseberries, white currants and other light coloured fruits, including green and yellow apples, a 2 per cent solution of zinc chloride in water was used.

For some red and dark grapes a solution of salicylic acid was employed with good results. One ounce of the acid was dissolved in eight ounces of alcohol and this solution added to two gallons of water.

Sulphurous acid was found very useful in brightening up and bleaching all discoloured specimens of white or yellow fruits, and gave them a very attractive appearance. The acid was used of the ordinary commercial strength in the proportion of four ounces to the gallon of fluid.

A short time prior to the closing of the Chicago Exposition I was requested to make a selection of the best of the preserved fruits which had been shown at Chicago, with the view of exhibiting them at Antwerp. As the preserved fruits prepared for Chicago were intended only for a summer exhibition, no necessity existed for making preparation against frost, but as it was then proposed to forward the Canadian exhibits to Antwerp about the middle of March, it was necessary for safe carriage to add to all the fluids a sufficient quantity of alcohol to prevent them from freezing.

An investigation was made by Dr. C. E. Saunders to determine the freezing points of weak mixtures of alcohol and water, for the purpose of ascertaining the smallest proportion of alcohol sufficient to prevent injury from frost during transportation. After many experiments it was found that a mixture of 15 parts of commercial alcohol 65 over proof with 85 parts of water was sufficient. This mixture was found to freeze at about 15 degrees above zero, but the frozen mass was of such a soft and yielding texture that when frozen solid in a thin Erlenmeyer flask the vessel was not broken, and a lead pencil could be easily pushed through the mass of fine loose crystals of ice.

Samples of fruits preserved in the solutions referred to are herewith submitted. These were put up during the summer of 1892, and hence have stood the test for more than a year and a-half, also the journey to Chicago and return, and the exposure there to the sunlight for six months.